



Sheet 1 of 1

Form PTO-1449

## INFORMATION DISCLOSURE CITATION

(Use several sheets if necessary)

Attorney Docket No.  
S243 1020.1Serial No.  
10/053,859Applicant  
Goodson, et al.Filing Date  
01/19/02Group  
3743

## U.S. PATENT DOCUMENTS

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
TM	A	5,880,071	03/99	Parce et al.	204	453	

## FOREIGN PATENT DOCUMENTS

	Document Number	Date	Country	Class	Subclass	Translation	
						Yes	No

## OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

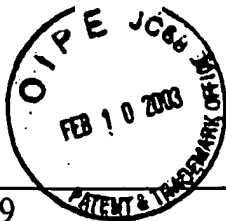

\* EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP § 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

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1/7/05 for all cited references

Patent and Trademark Office; U. S. DEPARTMENT OF COMMERCE



Form PTO-1449  INFORMATION DISCLOSURE CITATION  (Use several sheets if necessary)	Attorney Docket No. S243 1020.2	Serial No. 10/272,048
	Applicant Zeng et al.	
	Filing Date 10/16/02	Group 3743






## U.S. PATENT DOCUMENTS

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate

## FOREIGN PATENT DOCUMENTS

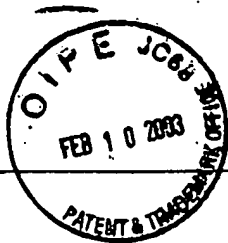
		Document Number	Date	Country	Class	Subclass	Translation	
							Yes	No

## OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

	A	"Micro-heat exchangers". Weisberg, et al., American Society of Mechanical Engineers, Dynamic Systems and Control Division; DSC, 1990, v.19, p.159-17
	B	"Manufacturing and testing of compact micro heat exchangers with high volumetric heat transfer coefficients", Bier, et al.. American Society of Mechanical Engineers, Dynamic Systems and Control Division, DSC, 1990, v19, p.189-197
	C	"Design and fabrication of a cross flow micro heat exchanger". Harris et al., Journal of Microelectromechanical Systems; Dec 2000; v.9. no.4, p.502-508
	D	"Two-phase electronic cooling using mini-channel and micro-channel heat sinks: Part I design criteria and heat diffusion constraints", Bowers. et al., Transactions of the ASME. Dec 1994, v.116. p.290-297
	E	"Active control of electroosmotic flow-in microchannels using light", Moorthy et al., Sensors and Actuators, B: Chemical; May 15, 2001; v.75, no.3, p.223-229

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Form PTO-1449

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S243 1020.2Serial No.  
10/272,048

## INFORMATION DISCLOSURE CITATION

Applicant  
Zeng et al.

(Use several sheets if necessary)

Filing Date  
10/16/02Group  
3743






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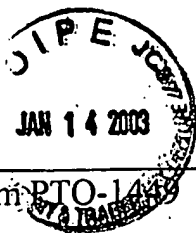
## OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

	AA	"Irrotationality of uniform electroosmosis", Cummings et al., Proceedings of SPIE - International Society for Optical Engineering; 1999; v.3877, p.180-189
	AB	"Bibliography of liquid cooled heat sinks for thermal enhancement of electronic packages, Shaukatul I ah, IEEE Semiconductor Thermal Measurement and Management Symposium, 1999, p.231-245
	AC	"Transient temperature performance of an integrated micro-thermal system", Jiang, et al., Journal of Micromechanics and Microengineering, Sep. 2000, v.10, p.466-476
	AD	"Phase change in microchannel heat sinks with integrated temperature sensors", .Jiang. et al., Journal of Microelectromechanical Systems, 1999, v.8. no. 4, p.358-365
	AE	"Electroosmotic pumping and electrophoretic separations for miniaturized chemical analysis systems", Manz. et al., j. Micronech.. Microeng., 1994, p.257-265

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**10/053,859**Applicant  
**Goodson, et al.**Filing Date  
**01/19/02**Group  
**3743**

## U.S. PATENT DOCUMENTS

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
<i>TM</i>	AA	5,869,894	02/97	Degani, et al.	257	723	
	AB	5,901,040	05/99	Cromwell, et al.	361	704	
	AC	6,025,208	02/00	Chui, et al.	438	50	
	AD	6,052,287	04/00	Palmer, et al.	361	767	
	AE	6,133,631	10/00	Belady	257	714	
	AF	6,137,693	10/00	Schwiebert, et al.	361	803	
	AG	6,191,945	02/01	Belady, et al.	361	704	
<i>TM</i>	AH	6,285,550	09/01	Belady	361	704	
<i>TM</i>	AI	6,297,551	10/01	Dudderar, et al.	257	723	

## FOREIGN PATENT DOCUMENTS

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							Yes	No
<i>TM</i>	AJ	97212126.9	07/98	China	B01D	61/42	X	

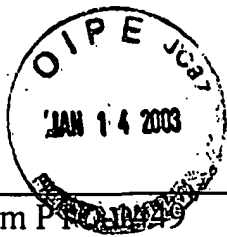
## OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

<i>TM</i>	AK	"Micro Channel Heat Exchanger for Cooling Electrical Equipment," Kawano, et al., American Society of Mechanical Engineers, Heat Transfer Division, (Publication) HTD; 1998; v. 361 - 3, p. 173 - 180
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Form PTO-1024  <b>INFORMATION DISCLOSURE CITATION</b>  (Use several sheets if necessary)	<b>Attorney Docket No.</b> <b>S243 1020.1</b>	<b>Serial No.</b> <b>10/053,859</b>
	<b>Applicant</b> <b>Goodson, et al.</b>	
	<b>Filing Date</b> <b>01/19/02</b>	<b>Group</b> <b>3743</b>

**U.S. PATENT DOCUMENTS**

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
JM	BA	4,009,423	02/77	Wilson	361	385	
	BB	4,067,237	01/78	Arcella	73	204	
	BC	4,120,019	10/78	Arii, et al.	361	385	
	BD	4,151,548	04/79	Klein, et al.	357	82	
	BE	4,392,362	07/83	Little	62	514	
	BF	4,638,854	07/83	Noren	165	76	
	BG	4,675,783	06/87	Murase, et al.	361	385	
	BH	4,697,427	10/87	Niggemann, et al.	62	119	
JM	BI	4,829,432	05/89	Hershberger, et al.	361	424	

**FOREIGN PATENT DOCUMENTS**

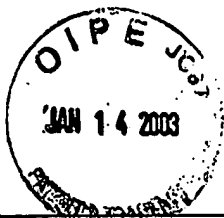
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							Yes	No

**OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)**

JM	BJ	"Experimental Study on an Enhanced Microchannel Heat Sink for Microelectronics Applications," Keska, et al.,
		American Society of Mechanical Engineers, EEP; 1999, v. 26 (2), p. 1235 - 1259

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	Applicant <b>Goodson, et al.</b>	
	Filing Date <b>01/19/02</b>	Group <b>3743</b>

## U.S. PATENT DOCUMENTS

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
<i>TM</i>	CA	4,858,093	08/89	Sturgeon	363	20	
	CB	4,938,280	07/90	Clark	165	80.4	
	CC	4,951,740	08/90	Peterson, et al.	165	32	
	CD	4,975,825	12/90	Huss, et al.	363	141	
	CE	5,010,292	4/91	Lyle, Jr.	323	274	
	CF	5,131,859	07/92	Bowen, et al.	439	194	
	CG	5,144,531	09/92	Go, et al.	361	382	
	CH	5,162,974	11/92	Currie	361	385	
<i>TM</i>	CI	5,199,165	4/93	Crawford, et al.	29	846	

## FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Subclass	Translation	
							Yes	No

## OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

<i>TM</i>	CJ	"High Performance Forced Air Cooling Scheme Employing Microchannel Heat Exchangers," Kleiner, et al., IEEE Transactions on Components, Packaging, and Manufacturing Tech., Part A, Dec 1995; v. 18, no. 4, p. 795- 804
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Form <del>PTO</del> 449  <b>INFORMATION DISCLOSURE CITATION</b>  <i>(Use several sheets if necessary)</i>	<b>Attorney Docket No.</b> <b>S243 1020.1</b>	<b>Serial No.</b> <b>10/053,859</b>
	<b>Applicant</b> <b>Goodson, et al.</b>	
	<b>Filing Date</b> <b>01/19/02</b>	<b>Group</b> <b>3743</b>

**U.S. PATENT DOCUMENTS**

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
TM	DA	5,229,915	07/93	Ishibashi, et al.	361	385	
	DB	5,311,397	05/94	Harshberger, et al.	361	683	
	DC	5,313,099	05/94	Tata, et al.	287	717	
	DD	5,339,214	08/94	Nelson	361	695	
	DE	5,365,749	11/94	Porter	62	259.2	
	DF	5,461,541	10/95	Wentland, Jr. et al.	361	707	
	DG	5,471,850	12/95	Cowans	62	223	
	DH	5,504,650	04/96	Katsui, et al.	361	697	
TM	DI	5,504,924	04/96	Ohashi, et al.	375	800	

**FOREIGN PATENT DOCUMENTS**

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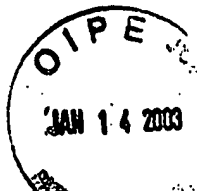
**OTHER DOCUMENTS** *(Including Author, Title, Date, Pertinent Pages, etc.)*

TM	DJ	"Optimal Thermal Design of Air Cooled Forced Convection Finned Heat Sinks, Experimental Verification," Knight, et al.,
		Conference: Intersociety Conference on Thermal Phenomena in Electronic Sysems - I-Therm '92, 2/5 - 8/92, Austin, TX

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Form <b>PTO 449</b>  <b>INFORMATION DISCLOSURE CITATION</b>  (Use several sheets if necessary)	<b>Attorney Docket No.</b> <b>S243 1020.1</b>	<b>Serial No.</b> <b>10/053,859</b>
	<b>Applicant</b> <b>Goodson, et al.</b>	
	<b>Filing Date</b> <b>01/19/02</b>	<b>Group</b> <b>3743</b>

**U.S. PATENT DOCUMENTS**

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
TM	EA	5,508,908	04/96	Kazama, et al.	363	141	
	EB	5,513,070	04/96	Xie, et al.	361	700	
	EC	5,544,412	08/96	Romero, et al.	29	832	
	ED	5,565,705	10/96	Romero, et al.	257	718	
	EE	5,579,827	12/96	Chung	165	80.3	
	EF	5,598,320	1/97	Toedtman, et al.	361	687	
	EG	5,608,262	3/97	Degani, et al.	257	723	
	EH	5,621,635	4/97	Takiar	363	141	
TM	EI	5,646,828	7/97	Degani, et al.	361	715	

**FOREIGN PATENT DOCUMENTS**

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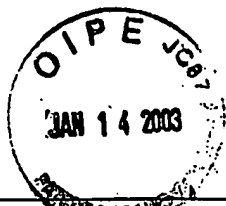
**OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)**

TM	EJ	"Heat Transfer of Microstructures for Integrated Circuits," Koh, et al. International Communications in Heat and Mass Transfer; Jan - Feb 1986; v. 13, no. 1, p. 89 - 98.

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Form PTO-449  INFORMATION DISCLOSURE CITATION  (Use several sheets if necessary)	Attorney Docket No. <b>S243 1020.1</b>	Serial No. <b>10/053,859</b>
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Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
PM	FA	6,034,425	03/00	Chiang, et al.	257	697	
	FB	6,121,682	09/00	Kim	257	723	
	FC	6,127,726	10/00	Bright, et al.	257	691	
	FD	6,154,370	11/00	Degani, et al.	361	761	
	FE	6,201,302	03/01	Tzu	257	724	
	FF	6,204,562	03/01	Ho, et al.	257	777	
	FG	6,215,193	04/01	Tao, et al.	257	777	
	FH	6,268,660	07/01	Dhong, et al	257	774	
PM	FI	6,278,190	08/01	Tomita	257	777	

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							Yes	No

## OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

PM	FJ	"Convection Cooling of Microelectronic Chips," Konecni, et al., Conference: Intersociety Conference on Thermal Phenomena in Electronic Systems - I-Therm '92, 2/5 - 8/92, Austin, Texas

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Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
<i>TM</i>	GA	6,335,566	01/02	Hirashima, et al.	257	686	
	GB	6,344,682	02/02	Tomita	257	686	
	GC	5,965,813	10/99	Wan, et al.	73	204.26	
	GD	5,965,001	10/99	Chow, et al.	204	600	
	GE	5,978,220	11/99	Frey, et al.	361	699	
	GF	5,997,713	12/99	Beetz, Jr., et al.	205	124	
	GG	5,998,240	12/99	Hamilton, et al.	438	122	
<i>✓</i>	GH	6,007,309	12/99	Hartley	417	322	
<i>TM</i>	GI	6,010,316	01/00	Haller, et al.	417	322	

## FOREIGN PATENT DOCUMENTS

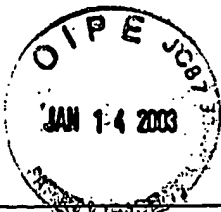
		Document Number	Date	Country	Class	Subclass	Translation	
							Yes	No

## OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

<i>TM</i>	GJ	"Modeling of Two-Phase Microchannel Heat Sinks for VLSI Chips," Koo, et al., Proceedings of the IEEE Micro Electro Mechanical Systems (MEMS); 2001; p. 422 - 426
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Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
TM	HA	5,801,442	09/98	Hamilton, et al.	257	714	
	HB	5,835,345	11/98	Staskus, et al.	361	699	
	HC	5,836,750	11/98	Cabuz	417	322	
	HD	5,858,188	01/99	Soane, et al.	204	454	
	HE	5,863,708	01/99	Zanzucchi, et al.	430	320	
	HF	5,870,823	02/99	Bezama, et al.	29	848	
	HG	5,880,524	03/99	Xie	257	704	
✓	HH	5,901,037	05/99	Hamilton, et al.	361	699	
TM	HI	5,940,270	08/99	Pucket	361	699	

## FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Subclass	Translation	
							Yes	No

## OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

TM	HJ	"Simulation of Micro-Channel Heat Sinks for Optoelectronic Microsystems," Kreutz, et al., Microelectronics Journal; October 2000; v. 31, no. 9, p. 787 - 790
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PM	IA	6,013,164	01/00	Paul, et al.	204	450	
	IB	6,019,882	02/00	Paul, et al.	204	450	
	IC	6,054,034	04/00	Soane, et al.	204	601	
	ID	6,096,656	08/00	Matzke, et al.	438	702	
	IE	6,101,715	08/00	Fuesser, et al.	29	890.03	
	IF	6,129,145	10/00	Yamamoto, et al.	165	168	
	IG	6,146,103	11/00	Lee, et al.	417	50	
✓	IH	6,154,363	11/00	Chang	361	699	
PM	II	6,174,675	01/01	Chow, et al.	435	6	

## FOREIGN PATENT DOCUMENTS

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							Yes	No

## OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

PM	IJ	"Fabrication of Very Smooth Walls and Bottoms of Silicon Microchannels for Heat Dissipation of Semiconductor Devices," Dwivedi, et al., Microelectronics Journal; 2000; v. 31, no. 6, p. 405 - 410.
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Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
<i>TM</i>	JA	6,210,986	01/01	Arnold, et al.	438	42	
	JB	6,216,343	04/01	Leland, et al.	29	890.032	
	JC	6,227,809	05/01	Forster, et al.	417	53	
	JD	6,234,240	05/01	Cheon	165	80.3	
	JE	6,238,538	05/01	Parce, et al.	204	600	
	JF	2001/0016985	08/21	Insley, et al.	29	890.039	
	JG	6,287,440	09/01	Arnold, et al.	204	450	
	JH	2001/0024820	09/01	Mastromatteo, et al.	435	287.2	
<i>TM</i>	JI	6,301,109	10/01	Chu, et al.	361	690	

## FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Subclass	Translation	
							Yes	No

OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, etc.)*

<i>TM</i>	JJ	"Silicon Micromachining and Micromachines," Esashi, Wear; September 1, 1993; v. 168
		No. 1 - 2, p. 181 - 187

\* EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP § 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

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Form PTO-1449

Attorney Docket No.  
**S243 1020.1**Serial No.  
**10/053,859**

## INFORMATION DISCLOSURE CITATION

*(Use several sheets if necessary)*Applicant  
**Goodson, et al.**Filing Date  
**01/19/02**Group  
**3743**

## U.S. PATENT DOCUMENTS

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
TM	KA	6,313,992	11/01	Hildebrandt	361	700	
	KB	2001/0044155	11/01	Paul, et al.	436	161	
	KC	6,321,791	11/01	Chow	137	833	
	KD	6,322,753	11/01	Lindberg, et al.	422	192	
	KE	6,324,058	11/01	Hsiao	361	699	
	KF	2001/0046703	11/01	Burns, et al.	435	303.1	
	KG	3,923,426	12/75	Theeuwes	417	48	
	KH	4,312,012	01/82	Frieser, et al.	357	82	
TM	KI	4,450,472	05/84	Tuckerman, et al.	357	82	

## FOREIGN PATENT DOCUMENTS

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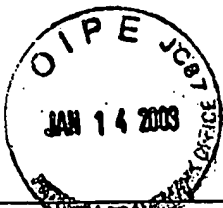
OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, etc.)*

TM	KJ	"Silicon Micromachining for Integrated Microsystems," Esashi, Vacuum; Jun - Aug 1996, v. 47, no. 6 - 8					
		pp. 469 - 474					

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Form PTO-449

Attorney Docket No.  
**S243 1020.1**Serial No.  
**10/053,859**

## INFORMATION DISCLOSURE CITATION

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**01/19/02**Group  
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## U.S. PATENT DOCUMENTS

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
TM	LA	4,516,632	05/85	Swift, et al.	165	167	
	LB	4,516,632	12/85	Eastman, et al.	361	385	
	LC	4,567,505	01/86	Pease, et al.	357	81	
	LD	4,573,067	02/86	Tuckerman, et al.	357	82	
	LE	4,758,926	07/88	Herrell, et al.	361	385	
	LF	4,868,712	09/99	Woodman	361	388	
V	LG	4,894,709	01/90	Phillips, et al.	357	82	
TM	LH	4,908,112	03/90	Pace	204	299	

## FOREIGN PATENT DOCUMENTS

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							Yes	No

OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, etc.)*

TM	LJ	"Experimental evaluation of micro heat exchangers fabricated in silicon", Kuan, American Society of Mechanical Engineers, Heat Transfer Division, (Publication) HTD; 1996; v.331, p.131-136
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	Applicant <b>Goodson, et al.</b>	
	Filing Date <b>01/19/02</b>	Group <b>3743</b>

**U.S. PATENT DOCUMENTS**

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
TM	MA	5,016,138	05/91	Woodman	361	381	
	MB	5,057,908	10/91	Weber	357	81	
	MC	5,070,040	12/91	Pankove	437	209	
	MD	5,083,194	01/92	Bartilson	357	81	
	ME	5,096,388	03/92	Weinberg	417	322	
	MF	5,099,311	03/92	Bonde, et al.	357	82	
	MG	5,125,451	06/92	Matthews	165	80.4	
✓	MH	5,099,910	03/92	Walpole, et al.	165	80.4	
TM	MI	5,131,233	07/92	Cray, et al.	62	64	

**FOREIGN PATENT DOCUMENTS**

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**OTHER DOCUMENTS** *(Including Author, Title, Date, Pertinent Pages, etc.)*

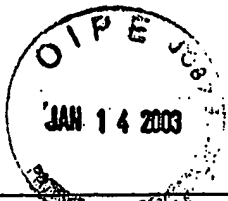
TM	MJ	"Flow characteristics of water through a microchannel between two parallel plates with electrokinetic effects", Mala et al., International Journal of Heat and Fluid Flow; Oct 1997; v.18, no.5, p.489-496
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Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
JM	NA	5,203,401	04/93	Hamburgen, et al.	165	80.4	
	NB	5,218,515	06/93	Bernhardt	361	385	
	NC	5,219,278	06/93	Van Lintel	417	413	
	ND	5,230,564	07/93	Bartilson, et al.	374	178	
	NE	5,232,047	08/93	Matthews	165	168	
	NF	5,239,200	08/93	Messina, et al.	257	714	
	NG	5,263,251	11/93	Matthews	29	840.036	
	NH	5,274,920	01/94	Matthews	29	890.039	
JM	NI	5,281,026	01/94	Bartilson, et al.	374	143	

## FOREIGN PATENT DOCUMENTS

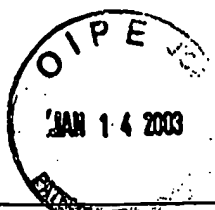
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## OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

JM	NJ	"Heat transfer and fluid flow in microchannels", Mala et al., International Journal of Heat and Mass Transfer; Sep 1997; v.40, no.13, p.3079-3088
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<i>TM</i>	OA	5,309,319	05/94	Messina	361	699	
	OB	5,317,805	06/94	Hoopman, et al.	29	890.03	
	OC	5,325,265	06/94	Turlik, et al.	361	702	
	OD	5,336,062	08/94	Richter	417	413	
	OE	5,383,340	01/95	Larson, et al.	62	259.2	
	OF	5,427,174	06/95	Lomolino, Sr., et al.	165	1	
	OG	5,436,793	07/95	Sanwo, et al.	361	689	
<i>✓</i>	OH	5,459,099	10/95	Hsu	437	180	
<i>TM</i>	OI	5,508,234	04/96	Dusablon, Sr., et al.	437	228	

## FOREIGN PATENT DOCUMENTS

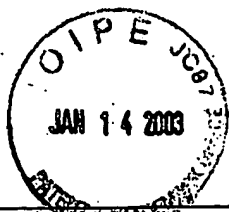
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							Yes	No

## OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

<i>TM</i>	OJ	"Enhancement of Multichip Modules ("MCMs) cooling by incorporating microheatpipes and other high thermal conductivity materials into microchannel heat sinks", Marongiu et al., Proceedings -Electronic Components and Technology Conference; 1998; p.45-50
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Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
<i>TM</i>	PA	5,514,832	05/96	Dusablon, Sr., et al.	174	15.1	
	PB	5,514,906	05/96	Love, et al.	257	712	
	PC	5,575,929	11/96	Yu, et al.	216	10	
	PD	5,641,400	06/97	Kaltenbach, et al.	210	198.2	
	PE	5,692,558	12/97	Hamilton, et al.	165	80.4	
	PF	5,696,405	12/97	Weld	257	714	
	PG	5,703,536	01/98	Davis, et al.	330	289	
<i>TM</i>	PH	5,704,416	01/98	Larson, et al.	165	104.33	
<i>TM</i>	PI	5,727,618	03/98	Mundinger, et al.	165	80.4	

## FOREIGN PATENT DOCUMENTS

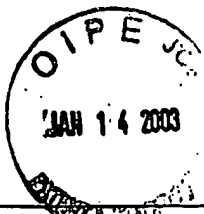
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							Yes	No

## OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

<i>TM</i>	PJ	"Integrated electroosmotic pumps and flow manifolds for total chemical analysis systems", Manz et al., Conference: 1991 International Conference on Solid-State Sensors and Actuators, 1991 Jun 24-28, San Francisco, CA, USA
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## U.S. PATENT DOCUMENTS

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
TM	QA	5,759,014	06/98	Van Lintel	417	413.3	
	QB	5,763,951	06/98	Hamilton, et al.	257	714	
	QC	5,774,779	06/98	Tuchinskiy	419	2	
	QD	2001/0055714	12/01	Cettour-Rose, et al.	429	122	
	QE	6,337,794	01/02	Agonafer, et al.	361	690	
	QF	5,942,093	08/99	Rakestraw, et al.	204	450	
	QG	6,351,384	02/02	Daikoku, et al.	361	704	
TM	QH	6,186,660	02/01	Kopf-Still, et al.	366	340	

## FOREIGN PATENT DOCUMENTS

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							Yes	No

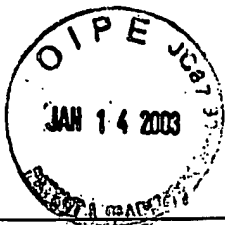
## OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

TM	QI	"Electroosmotically induced hydraulic pumping with integrated electrodes on microfluidic devices", McKnight et al., Analytical Chemistry; Aug 15, 2001; v.73, no.16, p.4045-4049
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## U.S. PATENT DOCUMENTS

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate
TM	RA	6,068,752	05/00	Dubrow, et al.	204	604	
	RB	6,090,251	07/00	Sundberg, et al.	204	453	
	RC	6,100,541	08/00	Nagle, et al.	250	573	
	RD	6,171,067	01/01	Parce	417	48	
	RE	6,176,962	01/01	Soane, et al.	156	292	
	RF	6,210,986	04/01	Arnold, et al.	438	42	
	RG	6,221,226	04/01	Kopf-Sill	204	602	
	RH	6,277,257	08/01	Paul, et al.	204	450	
	RI	5,216,580	09/93	Davidson, et al.	361	385	
TM	RJ	5,560,423	10/96	Larson, et al.	165	104.26	

## FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Subclass	Translation	
							Yes	No

## OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

TM	RK	"Microchannel heat sinks for two-dimensional high-power-density diode laser arrays", Missaggia et al., IEEE Journal of Quantum Electronics; Sep 1989; v.25, no.9, p.1988-1992
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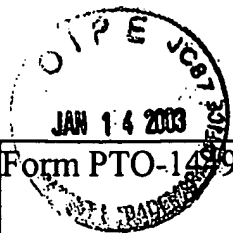
## OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

TM	SA	"Partial electroosmotic pumping in complex capillary systems. Part 1: Principles and general theoretical approach", Morf et al., Sensors and Actuators, B: Chemical; Feb 2001; v.72, no.3, p.266-272						
	SB	"High average power 2-D laser diode arrays on silicon microchannel collers", Mundinger et al., Conference: Conference on Lasers and Electro-Optics, 1989 Apr 24-28, Baltimore, MD, USA						
	SC	"Parametric optimization of multichanneled heat sinks for VLSI chip cooling", Murakami et al., IEEE Transactions on Components and Packaging Technologies; March 2001; v.24, no.1, p.2-9						
	SD	"Experimental investigation of heat transfer in flat plates with rectangular microchannets", Peng et al., International Journal of Heat and Mass Transfer; Jan 1995; v.38, no.1, p.127-137						
	SE	"Forced convection and flow boiling heat transfer for liquid flowing through microchannels", Peng et al., International Journal of Heat and Mass Transfer; Sep 1993; v.36, no.14, p.3421-3427						
	SF	"Enhancing the critical heat flux using microchanneled surfaces", Peng et al., Journal of Enhanced Heat Transfer; 1998; v.5, no.3, p.165-176						
	SG	"Cooling characteristics with microchannled structures", Peng et al., Journal of Enhanced Heat Transfer; 1994; v.1, no.4, p.315-326						
TM	SH	"Convective heat transfer and flow friction for water flow in microchannel structures", Peng et al., International Journal of Heat and Mass Transfer; Aug 1996; v.39, no.12, p.2599-2608						

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Form PTO-1499

## INFORMATION DISCLOSURE CITATION

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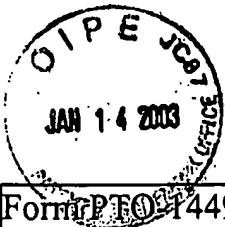
OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, etc.)*

	TA	"Heat transfer characteristics of water flowing through microchannels", Peng et al., Experimental Heat Transfer; Oct-Dec 1994; v.7, no. 4, p.265-283
	TB	"Microchannel integrated heat sinks in silicon technology", Perret et al., Conference Record - IAS Annual Meeting (IEEE Industry Applications Society); 1998; v.2, p.1051-1055
	TC	"Performance of a MEMS based micro capillary pumped loop for chip-level temperature control", Pettigrew et al., Proceedings of the IEEE Micro Electro Mechanical Systems (MEMS); 2001; p.427-430
	TD	"Liquid transport in micron and submicron channels", Pfahler et al., Sensors and Actuators, A: Physical; 3 Pt3 1990; v.22, no. 1-3, p.431-434
	TE	"Experimental measurements of fluid flow and heat transfer in microchannel cooling passages in a chip substrate", Rahman et al., American Society of Mechanical Engineers, EEP; 1993; v.4-2, p.685-692
	TF	"Flow rate measurement via conductivity monitoring in micro-fluidic devices", Rainey et al., Proceedings of SPIE - The International Society for Optical Engineering; 2000; v. 4177, p. 185-193
	TG	"Fabrication techniques to realize CMOS-compatible microfluidic microchannels", Rasmussen et al., Journal of Microelectromechanical Systems; June 2001; v. 10, no. 2, p.286-297
	TH	"Impact of channel geometry on two-phase flow heat transfer characteristics of refrigerants in microchannel heat exchangers", Ravigururajan, Journal of Heat Transfer, Transactions ASME; May 1998; v.120, no.2, p.485-491

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Form PTO-1449

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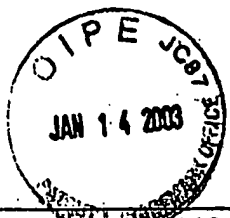
	UA	"Liquid flow characteristics in a diamond-pattern micro-heat-exchanger", Ravigururajan et al., American Society of Mechanical Engineers, Dynamic Systems and Control Division (Publication) DSC; 1996; v.59, p.159-166
	UB	"Single-phase flow thermal performance characteristics of a parallel micro-channel heat exchanger", Ravigururajan et al., American Society of Mechanical Engineers, Heat Transfer Division, (Publication) HTD; 1996; v.329, no. 7, p.157-166
	UC	"Effect of heat flux on two-phase flow characteristics of refrigerant flows in a micro-channel heat exchanger", Ravigururajan et al., American Society of Mechanical Engineers, Heat Transfer Division, (Publication) HTD; 1996; v.329, no. 7, p.167-178
	UD	"Acousto-and electroosmotic microfluidic controllers", Rife et al., Proceedings of SPIE - The International Society for Optical Engineering; 1998; v.3515, p.125-135
	UE	"Liquid flow and heat transfer in microchannels: A review", Rostami et al., Heat and Technology; 2000; v.18, no. 2, p.59-68"
	UF	"Very high heat flux microchannel heat exchanger for cooling of semiconductor laser diode arrays", Roy et al., IEEE Transactions on Components, Packaging, and Manufacturing Technology Part B: Advanced Packaging; May 1996; v.19, no.2, p.444 - 451
	UG	"Convective heat transfer in microchannels", Samalam, Journal of Electronic Materials, Vol. 18, pp. 611-617, 1989

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OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, etc.)*

<i>TM</i>	VA	"Optimal structure for microgrooved cooling fin for high-power LSI devices", Sasaki, S.; Kishimoto, Electronics Letters; Dec 4, 1986; v.22, no. 25, p.1332-1334						
	VB	"Electroosmotic pumping and valveless control of fluid flow within a manifold of capillaries on a glass chip", Seiler, et al., Analytical Chemistry; October 15, 1994; v.66, no. 20, p.3485-3491						
	VC	"Micro heat spreader enhanced heat transfer in MCMs", Shen et al., Proceedings of the IEEE Multi-Chip Module Conference; January 31, 1995; p.189-194						
	VD	"Microflow devices and systems", Shoji et al., Journal of Micromechanics and Microengineering; Dec 1994; v.4, no.4, p.157-171						
	VE	"Overview of fabrication methods and fluid flow and heat transfer characteristics of micro channels", Sunden et al., Conference: Second Baltic Heat Transfer Conference, 1995 Aug 21-23, Jurmala, Latvia						
<i>✓</i>	VF	"Electrokinetic dewatering and thickening. I. Introduction and historical review of electrokinetic applications", Sunderland, J Appl Electrochem; Sep 1987; v.17, no.5, p.889-898						
<i>TM</i>	VG	"High-performance heat sinking for VLSI", Tuckerman et al., IEEE Electron Device Lett; May 1981; v.EDL-2, no. 5, p.126-129						

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	WA	"Analysis of two-layered micro-channel heat sink concept in electronic cooling", Vafal et al., International Journal of Heat and Mass Transfer; Jun 1999; v.42, no. 12, p.2287-2297						
	WB	"Two-phase flow in microchannels", Stanley, et al., Microelectromechanical Systems (MEMS), DSC-Vol. 62/HTD-Vol.254, p.143-152						
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	WE	"Micro fluidic system of micro channels with on-site sensors by silicon bulk micromachining", Yang et al., Proceedings of SPIE - The International Society for Optical Engineering; 1999; v. 3877, p.267-272						
	WF	"Modeling forced liquid convection in rectangular microchannels with electrokinetic effects", Yang et al., International Journal of Heat and Mass Transfer; Dec 1998; v.41, no. 24, p.4229-4249						
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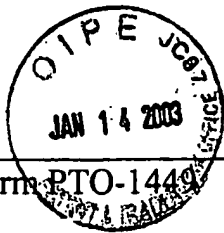
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	XD	"Heat out of small packages", Joshi, Mechanical Engineering, Dec. 2001, p.56-58					
	XE	"Heat Exchange Element for Semiconductor Device Cooling", Edmonds, et al., IBM Technical Disclosure Bulletin, Aug 1980, v.23, no.3, p.1057					
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	YC	"Liquid jet cooling of integrated circuit chips", Sachar, IBM Technical Disclosure Bulletin, Feb 1978, v.20, no.9, p.3727-3728					
	YD	"Centerless ceramic package with directly connected heat sink", Ronkese, IBM Technical Disclosure Bulletin, Feb 1978, v.20, no.9, p.3577-3578					
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<i>↓</i>	YG	"Integrated circuit module package cooling structure", Pascuzzo, et al., IBM Technical Disclosure Bulletin, Mar 1978, v.20, no.10, p.3898-3899					
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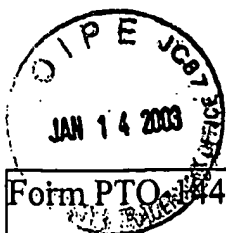
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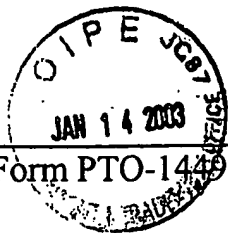
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	AAB	"Convection cooling apparatus", Damm, IBM Technical Disclosure Bulletin, Dec 1977, v.20, no.7, p.2755-2756						
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	AAD	"Circuit module cooling with multiple pistons contacting a heat spreader/electrical buffer plate in contact with chip", IBM Technical Disclosure Bulletin, May 1989, v.31, no.12, p.5-7						
	AAE	"Circuit package with circulating boiling liquid and local heat exchanger to limit vapor in coolant outlet", IBM Technical Disclosure Bulletin, May 1989, v.31, no.12, p. <sup>34</sup>						
	AAF	"Water-cooled circuit module with grooves forming water passages near heat-producing devices", IBM Technical Disclosure Bulletin, May 1989, v.31, no.12, p.49-50						
<i>V</i>	AAG	"Cold plate for thermal conduction module with only peripheral mounting bolts, large surface area fin inserts and reduced water flow and thermal resistances", IBM Technical Disclosure Bulletin, May 1989, v.31, no.12, p.59						
<i>TM</i>	AAH	"Thermal control hardware for accelerated run-in testing of multi-chip modules", IBM Technical Disclosure Bulletin, Oct 1989, v.32, no.5A, p.129-130						

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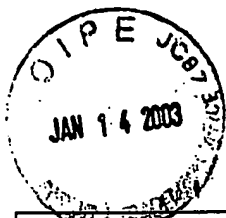
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	ABE	"Pin fin array heat pipe apparatus", IBM Technical Disclosure Bulletin, Sep 1994, v.37, no.09, p.171
	ABF	"Heat sink fabrication method", IBM Technical Disclosure Bulletin, Mar 1985, v.27, no.10A, p.5656-5657
	ABG	"Thermal conduction module with liquid dielectric and pistons with surface treatment for enhanced nucleate boiling", IBM Technical Disclosure Bulletin, May 1985, v.27, no.12, p.6904
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	ACB	"Heat-pipe vapor cooling etched silicon structure", Eldridge, et al., IBM Technical Disclosure Bulletin, Jan 1983, v.25, no.8, p.4118-4119					
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	ACD	"Data processor cooling with connection to maintain flow through standby pump", Goodman, IBM Technical Disclosure Bulletin, Dec 1983, v.26, no.7A, p.3325					
	ACE	"Cooling system for data processor with flow restricter in secondary loop to limit bypass-cooling water flow", Gallagher, et al., IBM Technical Disclosure Bulletin, Oct 1983, v.26, no.5, p.2658					
	ACF	"Cold plate for thermal conduction module with improved flow pattern and flexible base", Hwang, et al., IBM Technical Disclosure Bulletin, Feb 1983, v.25, no.9, p.4517					
<i>V</i>	ACG	"Structure for the removal of heat from an integrated circuit module", Arnold, IBM Technical Disclosure Bulletin, Nov 1979, v.22, no.6, p.2294-2296					
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<i>TM</i>	ADA	"Distributed power/thermal control", Chrisfield, et al, IBM Technical Disclosure Bulletin, Aug 1979, v.22, no. 3, p.1131-1132
	ADB	"Liquid-filled bellows heat sink", Kleinfelder, et al., IBM Technical Disclosure Bulletin, Mar 1979, v.21, no. 10, p.4125-4126
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	ADD	"Silicon heat sink method to control integrated circuit chip operating temperatures", Ahearn, et al., IBM Technical Disclosure Bulletin, Jan 1979, v.21, no. 8, p.3378-3380
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	ADF	"Cooling system for chip carrier on card", IBM Technical Disclosure Bulletin, Sep 1988, v.31, no. 4, p.39-40
<i>V</i>	ADG	"Piping system with valves controlled by processor for heating circuit modules in a selected temperature profile for sealing integrity test under temperature stress", IBM Technical Disclosure Bulletin, Oct 1987, v.30, no. 5, p.336
<i>TM</i>	ADH	"Circuit module cooling with coaxial bellows providing inlet, outlet and redundant connections to water-cooled element", IBM Technical Disclosure Bulletin, Oct 1987, v.30, no. 5, p.345-347

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	AEF	"Process for nucleate boiling enhancement", Chu, et al., IBM Technical Disclosure Bulletin, Dec 1975, v.18, no. 7, p.2227
	AEG	"Electroerosion micropump", IBM Technical Disclosure Bulletin, May 1990, v.32, no. 12, p.342-343
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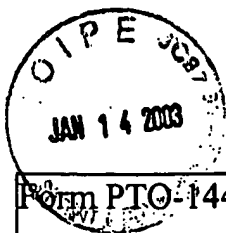
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	AFF	"Semiconductor laser body heat sink", Tramontana, Xerox Disclosure Journal, Dec 1985, v.10, no.6, p379-381					
<i>V</i>	AFG	"Heat generation and transport in sub-micron semiconductor devices", Fushinobu et al., American Society of Mechanical Engineers, Heat Transfer Division, (Publication) HTD; 1993; v.253, p.21-28					
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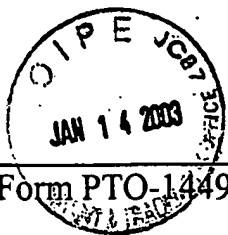
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	AGB	"Microchannel heat exchangers: a review", Goodling, Proceedings of SPIE - The International Society for Optical Engineering; 1993; v.1997, p.66-82						
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	AHC	"Micro-channel heat sink with integrated temperature sensors for phase transition study", Jiang et al., Proceedings of the IEEE Micro Electro Mechanical Systems (MEMS); 1999; p.159-164						
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	AHE	"Micro heat exchangers fabricated by diamond machining", Friedrich, et al., Precision Engineering, v.16, no.1, Jan 1994, p.56-59						
	AHF	"Electroosmotic flow control in micro channels produced by scanning excimer laser ablation", Wagner et al., Proceedings of SPIE - The International Society for Optical Engineering; 2000; v.4088, p.337-340						
	AHG	"Thermal management in semiconductor device packaging", Mahalingam, Proceedings of the IEEE, v.73, no.9, Sep 1985, p.1396-1404						
<i>TM</i>	AHH	"Applicability of Traditional turbulent single-phase forced convection correlations to non-circular microchannels", Adams et al., International Journal of Heat and Mass Transfer, 1999; v.42, no.23, p.4411-4415						

\* EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP § 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to the applicant.

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## INFORMATION DISCLOSURE CITATION

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Attorney Docket No.  
S243 1020.1Serial No.  
10/053,859Applicant  
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3743

## U.S. PATENT DOCUMENTS

Examiner Initials	Item	Document Number	Date	Name	Class	Subclass	Filing Date If Appropriate

## FOREIGN PATENT DOCUMENTS

		Document Number	Date	Country	Class	Subclass	Translation	
							Yes	No

## OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, etc.)

TM	AIA	"Experimental investigation of single-phase forced convection in microchannels", Adams et al., International Journal of Heat and Mass Transfer; Mar-Apr 1998; v.41, no.6-7, p.851-857					
	AIB	"Liquid transport in rectangular microchannels by electroosmotic pumping", Arulanandam et al., Colloids and Surfaces A: Physicochemical and Engineering Aspects; 2000; v.161, no.1, p.89-102					
	AIC	"Experimental results for low-temperature silicon micromachined micro heat pipe arrays using water and methanol as working fluids", Badran et al., Experimental Heat Transfer; Oct-Dec 1997; v.10, no.4, p.253-272					
	AID	"Optimization of conduits' shape in micro heat exchangers", Bau, International Journal of Heat and Mass Transfer; Sep 1998; v.41 no.18, p.2717-2723					
	AIE	"Modular microchannel cooled heatsinks for high average power laser diode arrays", Beach et al., IEEE Journal of Quantum Electronics; Apr 1992; v.28, no.4, p.966-976					
	AIF	"Two-phase electronic cooling using mini-channel and micro-channel heat sinks: Part 2- flow rate and pressure drop constraints", Bowers et al., Journal of Electronic Packaging, Transactions of the ASME; Dec 1994; v.116, no.4, p.298-305					
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V	AJG	"Micromachining of buried micro channels in silicon", de Boer et al., Journal of Microelectromechanical Systems; 2000; v.9, no.1, p.94-103						
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